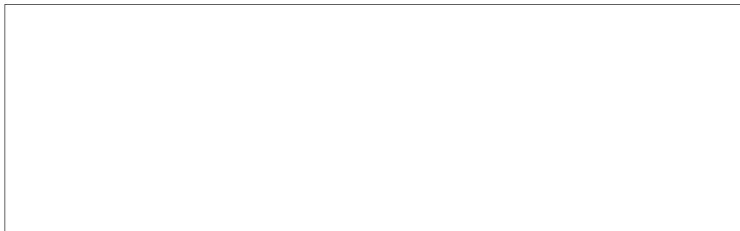


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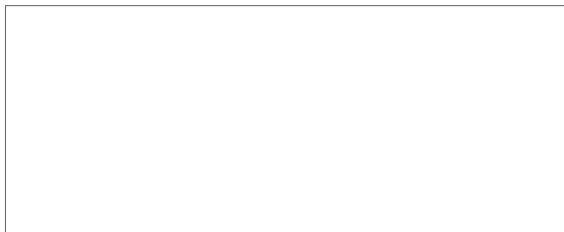


**Test Report**

**RR-2B**

**N.E.M.S. Prototype #3000**

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**26 April 1953**

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Figure #1 : Selectivity

Figure #2 : Frequency Stability During Warm-Up

Figure #3 : Frequency Stability During Warm-Up

Figure #4 : Frequency Stability During Warm-Up

Figure #5 : Frequency Stability Vs. B / Supply Voltage

Figure #6 : Overall Audio Frequency Response

## 1. Introduction

The N.E.M.S. prototype model of the RR-2B receiver, serial #3000 was submitted to the Analysis and Appraisal Unit of Research and Development for prototype approval testing. The following tests were conducted to determine whether or not this receiver meets specifications.

## 2. Summary

A number of mechanical and electrical defects were found in the RR-2B. Despite these however, the receiver's performance on the majority of the tests conducted indicate that it will be acceptable as a prototype after some reworking by the manufacturer.

## 3. Mechanical Section

### 3.1. Size and Weight

Size: 8 3/4" x 5 9/16" x 5 3/8"

Weight: 8 pounds and 11 ounces.

### 3.2. Mechanical Inspection

The following mechanical defects were found during the RR-2B prototype inspection:

- (a) The tuning dial binds for a few degrees while it is being rotated.
- (b) The center gear of the dial drive train is sloppy and nearly runs out of mesh.
- (c) There is no Glyptal sealer on the condenser shaft and dial drive set screws.
- (d) Additional slack is desirable in the front ground straps of the tuning condenser.
- (e) A hard surfaced insulating material, such as phenolic sheet, should be inserted as a spacer between the two sub-chassis.
- (f) The Rosan inserts should be installed in the case with greater care to insure that they are straight and flush with the surface.
- (g) The indexing of the wafer in the RF portion of the bandswitch should be improved.
- (h) The small metalized tubular by-pass condenser next to the I.F. sub-chassis cover should be relocated to prevent possible shorting.

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### 3.3. Mechanical Tests

#### 3.3.1. Submersion

The RR-2B was completely submerged in fresh water for a period of 40 hours. At the end of this time a silica-gel relative humidity indicator which had been placed inside the cover showed no signs of leakage or change in relative humidity.

### 4. Electrical Section

#### 4.1. Electrical Tests

##### 4.1.1. Antenna Input Impedance

| Band | Frequency<br>(mcs.) | Impedance<br>(ohms) |
|------|---------------------|---------------------|
| 1    | 3.0                 | 26                  |
|      | 4.5                 | 20                  |
|      | 6.0                 | 80                  |
| 2    | 6.0                 | 406                 |
|      | 9.0                 | 765                 |
|      | 12.0                | 627                 |
| 3    | 12.0                | 105                 |
|      | 18.0                | 211                 |
|      | 24.0                | 195                 |

The test was conducted in accordance with the following specification.:  
No. 50-A-1003-A, Para. C-13.

##### 4.1.2. Selectivity

See the curve of Figure #1

The test was conducted in accordance with the following specifications  
No. 50-A-1003-A, Para. F-2.

## 4.1.3. Sensitivity

| Band | Frequency<br>(mcs.) | Raw Noise<br>(mw.) |      | 10 db. S/N<br>(uv.) |    |
|------|---------------------|--------------------|------|---------------------|----|
|      |                     | AM                 | CW   | AM                  | CW |
| 1    | 3.0                 | 0.10               | 0.38 | 2.0                 | *  |
|      | 3.5                 | 0.10               | 0.37 | 2.1                 |    |
|      | 4.1                 | 0.05               | 0.23 | 2.0                 |    |
|      | 4.8                 | 0.10               | 0.33 | 2.0                 |    |
|      | 5.5                 | 0.60               | 1.00 | 2.2                 |    |
|      | 6.0                 | 1.50               | 2.00 | 2.1                 |    |
| 2    | 6.0                 | 0.02               | 0.05 | 1.10                |    |
|      | 7.0                 | 0.03               | 0.09 | 1.10                |    |
|      | 8.2                 | 0.03               | 0.12 | 0.85                |    |
|      | 9.6                 | 0.04               | 0.13 | 0.80                |    |
|      | 11.0                | 0.03               | 0.12 | 0.82                |    |
|      | 12.0                | 0.03               | 0.08 | 0.83                |    |
| 3    | 12.0                | 0.01               | 0.02 | 1.40                |    |
|      | 14.0                | 0.01               | 0.03 | 0.80                |    |
|      | 16.4                | 0.01               | 0.05 | 0.92                |    |
|      | 19.2                | 0.01               | 0.07 | 0.92                |    |
|      | 22.0                | 0.02               | 0.07 | 0.95                |    |
|      | 24.0                | 0.02               | 0.05 | 0.91                |    |

\* The CW sensitivity is better than the AM sensitivity (requiring less signal to produce a 10 db. S/N ratio). This test was not included in the specification.

The tests were conducted in accordance with the following specifications and modifications: No. 50-A-1003-A, Para. F-3.  
11 October 1950, Para. 3.2.4 and 4.2.6.  
No. 52-A-1022-A, Para. 2.2.

## 4.1.4. Stability

## 4.1.4.1. Frequency Stability During Warm-Up

See the curves of Figures #2, #3, and #4.

The test was conducted in accordance with the following specifications and modifications: No. 50-A-1003-A, Para. F-4.  
No. 52-A-1022-A, Para. 1.3.

4.1.4.2. Frequency Stability Vs. B  $\neq$  Supply Voltage Variation

See the curve of Figure #5.

## 4.1.4.3. Hand Capacity Effects

The RR-2B was practically immune to the effects of hand capacity upon its frequency.

## 4.1.4.4. Mechanical Stability

Jarring and other rough handling did not cause excessive frequency shift.

## 4.1.5. Image Rejection Ratio

| Band | Test Frequency<br>(mcs.) | Rejection Ratio<br>(db) |
|------|--------------------------|-------------------------|
| 1    | 6.0                      | 57.0                    |
| 2    | 12.0                     | 32.0                    |
| 3    | 24.0                     | 38.4                    |

This test was conducted in accordance with the following specifications and modifications: No. 50-A-1003-A, Para. F-3  
11 October 1950, Para. 4.2.4.  
No. 52-A-1022-A, Para. 1.2.

## 4.1.6. I.F. Rejection Ratio

| Band | Test Frequency<br>(mcs.) | I.F. Frequency<br>(mcs.) | Rejection Ratio<br>(db) |
|------|--------------------------|--------------------------|-------------------------|
| 1    | 6.0                      | 0.455                    | 100 $\neq$              |
| 2    | 12.0                     | 0.455                    | 100 $\neq$              |
| 3    | 24.0                     | 0.455                    | 100 $\neq$              |

## 4.1.7. Spurious Response Rejection Ratio

## 4.1.7.1. External Spurious Response

| Band | Receiver<br>Frequency<br>(mcs.) | Spurious<br>Frequency<br>(mcs.) | Response<br>(db) |
|------|---------------------------------|---------------------------------|------------------|
| 1    | 3.0                             | *                               | —                |
|      | 4.5                             | 4.40                            | 79.5             |
|      | 4.5                             | 4.42                            | 76.3             |
|      | 6.0                             | *                               | —                |
| 2    | 6.0                             | *                               | —                |
|      | 9.0                             | 9.535                           | 78.6             |
|      | 12.0                            | 12.20                           | 54.9             |
|      | 12.0                            | 12.30                           | 66.2             |
|      | 12.0                            | 12.35                           | 75.8             |
|      | 12.0                            | 12.70                           | 77.4             |
|      | 12.0                            | 24.50                           | 77.7             |
|      | 12.0                            | 25.40                           | 78.5             |
|      |                                 |                                 |                  |
| 3    | ** 14.0                         | *                               | —                |
|      | 18.0                            | *                               | —                |
|      | 24.0                            | *                               | —                |

\* There were no spurious responses less than 80 db at these receiver frequencies.

\*\* This test was conducted at 14 mcs rather than at 12 mcs due to the high value of raw sensitivity existing at the low end of band #3.

These tests were conducted in accordance with the following specifications and modifications: No. 50-A-1003-A, Para. F-6.  
No. 52-A-1022-A, Para. 1.4.

## 4.1.7.2. Internal Spurious Response

No internal spurious responses were detected in the RR-2B receiver.

## 4.1.8. Overall Audio Frequency Response

See the curve of Figure #6.



## 4.1.9. Cross Signal Distortion Products

| Band | Frequency<br>(mcs.)          | Db.          |
|------|------------------------------|--------------|
| 1    | 5.45 (Difference Frequency)  | 100 $\nless$ |
|      | 5.95 (Sum Frequency)         | 95.4         |
| 2    | 11.45 (Difference Frequency) | 78.4         |
|      | 11.95 (Sum Frequency)        | 83.3         |
| 3    | 23.45 (Difference Frequency) | 100 $\nless$ |
|      | 23.95 (Sum Frequency)        | 100 $\nless$ |

These tests were conducted in accordance with the following specifications and modifications: No. 50-A-1003-A, Para. F-7.  
No. 52-A-1022-A, Para. 1.5.

## 4.1.10 Harmonic Distortion

| Frequency<br>(cycles) | Fundamental<br>% | 2nd Harmonic<br>Distortion<br>% | 3rd Harmonic<br>Distortion<br>% |
|-----------------------|------------------|---------------------------------|---------------------------------|
| 300                   | 100              | 3.0                             | 0.50                            |
| 600                   | 100              | 3.6                             | 1.00                            |
| 1200                  | 100              | 2.8                             | 0.40                            |
| 2400                  | 100              | 2.2                             | 0.65                            |

Test Frequency: 4.5 mcs.

## 4.1.11. Local Oscillator Pulling

| Band | Frequency<br>(mcs.) | Cycles Shift Caused<br>By Decreasing The<br>Rcvr Gain Control<br>From Max to Min. | Cycles Shift Caused By<br>Increasing The RF Sig.<br>Gen. Input From 2 to<br>200,000 uv. |
|------|---------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| 1    | 4.5                 | 280                                                                               | 250                                                                                     |
| 2    | 9.0                 | 1070                                                                              | 700                                                                                     |
| 3    | 18.0                | 1550                                                                              | 10000                                                                                   |

## 4.1.12. Crystal H.F.O. Operation

| Band | Receiver<br>Frequency<br>(mcs.) | Crystal<br>Frequency<br>(mcs.) | AM Sensitivity<br>(uv) |
|------|---------------------------------|--------------------------------|------------------------|
| 1    | 4.531                           | 4.986 (I)                      | 2.3                    |
| 1    | 4.547                           | 2.501 (II)                     | 5.0                    |
| 2    | 9.517                           | 4.986 (II)                     | 1.0                    |
| 2    | 9.448                           | 3.301 (III)                    | 0.7                    |
| 3    | 18.144                          | 6.203 (III)                    | 0.9                    |

These tests were conducted in accordance with the following specifications: No. 50-A-1003-A, Para. F-5  
11 October 1950, Para. 4.2.3.

## 4.1.13. B.F.O. Operation

The RR-2B B.F.O. meets the requirement specified below.

Specification and modification: No. 50-A-1003-A, Para. C-15  
11 October 1950, Para. 4.2.5.  
No. 52-A-1022-A, Para. 2.1.

## 4.1.14. Dial Calibration Accuracy

| Band | Receiver Dial<br>Setting (mcs) | Error<br>(cycles) | Error<br>Parts in 1800 |
|------|--------------------------------|-------------------|------------------------|
| 1    | 3.0                            | 3440              | 2.06                   |
|      | 3.3                            | 250               | 0.14                   |
|      | 3.6                            | - 2400            | 1.20                   |
|      | 3.9                            | - 3620            | 1.67                   |
|      | 4.2                            | - 5000            | 2.14                   |
|      | 4.5                            | - 3920            | 1.57                   |
|      | 4.8                            | - 6030            | 2.26                   |
|      | 5.1                            | 380               | 0.13                   |
|      | 5.4                            | 3250              | 1.08                   |
|      | 5.7                            | 3820              | 1.20                   |
|      | 6.0                            | 4790              | 1.44                   |
| 2    | 6.0                            | - 50              | 0.02                   |
|      | 6.6                            | 2780              | 0.76                   |
|      | 7.2                            | 3420              | 0.86                   |
|      | 7.8                            | - 4550            | 1.05                   |
|      | 8.4                            | - 8400            | 1.80                   |
|      | 9.0                            | - 2050            | 0.41                   |
|      | 9.6                            | - 3300            | 0.62                   |
|      | 10.2                           | - 4750            | 0.84                   |
|      | 10.8                           | - 150             | 0.03                   |
|      | 11.4                           | - 8050            | 1.28                   |
|      | 12.0                           | - 2800            | 0.42                   |
| 3    | 12.0                           | 3060              | 0.46                   |
|      | 13.2                           | 4920              | 0.67                   |
|      | 14.4                           | - 1050            | 0.16                   |
|      | 15.6                           | 16440             | 1.90                   |
|      | 16.8                           | 20240             | 2.17                   |
|      | 18.0                           | 19400             | 1.94                   |
|      | 19.2                           | 9200              | 0.86                   |
|      | 20.4                           | - 2600            | 0.23                   |
|      | 21.6                           | 2070              | 0.17                   |
|      | 22.8                           | - 9680            | 0.76                   |
|      | 24.0                           | - 9290            | 0.70                   |

This test was conducted in accordance with the following specifications:  
 No. 50-A-1003-A, Para. C-10  
 11 October 1950, Para. 4.2.1.

## 4.1.15. Resetability

| Band | Frequency<br>(mcs.) | Error<br>(Parts in 1800) |
|------|---------------------|--------------------------|
| 1    | 4.5                 | 0.072                    |
| 2    | 9.0                 | 0.092                    |
| 3    | 18.0                | 0.184                    |

This test was conducted in accordance with the following specifications:  
 No. 50-A-1003-A, Para. C-11.  
 11 October 1950, Para. 4.2.1.

## 4.1.16. Receiver Radiation

| BAND             | Frequency<br>(mcs.) | Radiation in uv/meter           |                                    |                                    |
|------------------|---------------------|---------------------------------|------------------------------------|------------------------------------|
|                  |                     | Fundament<br>Frequency<br>(cps) | 2nd Harmonic<br>Frequency<br>(cps) | 3rd Harmonic<br>Frequency<br>(cps) |
| Local Oscillator |                     |                                 |                                    |                                    |
| 1                | 3.0                 | 10,000                          | 52                                 | -----                              |
|                  | 4.5                 | 7,000                           | 35                                 | -----                              |
|                  | 6.0                 | 3,600                           | 34                                 | -----                              |
| 2                | 6.0                 | 640                             | 25                                 | -----                              |
|                  | 9.0                 | 600                             | 50                                 | -----                              |
|                  | 12.0                | 650                             | 130                                | -----                              |
|                  | 12.0                | 1,800                           | 30                                 | -----                              |
|                  | 18.0                | 5,500                           | *                                  | -----                              |
|                  | 24.0                | 6,000                           | *                                  | -----                              |
| B. F. O.         |                     |                                 |                                    |                                    |
|                  | .455                | 2,600                           | 60                                 | -----                              |

## 4.1.17. Input Power Requirements

A  $\angle$  : 1.24 volts at 274 ma.

B  $\angle$  : 98.0 volts at 16.2 ma.

The Power Supply used was a RP-1 operated from a 110 volt line.

This test was conducted in accordance with the following specification: No. 50-A-1003-A, Para. C-14.

## 5. Summary of Test Results

The RR-2B receiver did not meet specifications in the following tests.

## (a) Antenna Input Impedance

Specified: nominally 400 ohms

Test results: 20 to 765 ohms

## (b) Frequency Stability During Warm-Up

Specified: 0.02% maximum

|               |                 |                  |
|---------------|-----------------|------------------|
| Test Results: | <u>Band 1</u>   | <u>Band 2</u>    |
|               | 3.0 mc.- 0.023% | 6.0 mc.- 0.032%  |
|               | 6.0 mc.- 0.052% | 12.0 mc.- 0.046% |

## (c) Spurious Response Rejection Ratio (External)

Specified: 80 db or better

Test results: 54.9 db (worst condition)

## (d) Cross Signal Distortion Products

Specified: 90 db or better

Test results: 78.4 db (Band 2)

## (e) Local Oscillator Pulling

There is no specification covering this test but it is felt that the local oscillator pull is excessive.

## 5. Summary of Test Results (Continued)

## Antenna Input Impedance

| Band | Frequency<br>(mcs.) | RDR #3566   |             |             | RDR #3688   |             |             | RDR #3633   |             |             |
|------|---------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
|      |                     | R<br>(ohms) | X<br>(ohms) | Z<br>(ohms) | R<br>(ohms) | X<br>(ohms) | Z<br>(ohms) | R<br>(ohms) | X<br>(ohms) | Z<br>(ohms) |
| 1    | 3.0                 | 49          | 43(L)       | 65          | 36          | 18(L)       | 43          | 18          | 34(L)       | 38          |
|      | 4.5                 | 38          | 24(C)       | 45          | 58          | 1.3(L)      | 58          | 94          | 10(L)       | 95          |
|      | 6.0                 | 92          | 43(L)       | 102         | 60          | 42(L)       | 73          | 37          | 86(L)       | 94          |
| 2    | 6.0                 | 248         | 108(C)      | 270         |             |             |             |             |             |             |
|      | 9.0                 | 206         | 233(C)      | 311         | 323         | 206(C)      | 383         | 140         | 172(C)      | 222         |
|      | 12.0                | 252         | 261(C)      | 363         |             |             |             |             |             |             |
| 3    | 12.0                | 176         | 22(C)       | 177         |             |             |             |             |             |             |
|      | 12.0                | 172         | 81(C)       | 190         | 360         | 67(C)       | 366         | 547         | 133(L)      | 562         |
|      | 24.0                | 208         | 63(C)       | 211         |             |             |             |             |             |             |

## Spurious Response Rejection Ratio (External)

| Band | Receiver<br>Frequency<br>(mcs.) | Spurious<br>Frequency<br>(mcs.) | Rejection Ratio (db) |           |           |
|------|---------------------------------|---------------------------------|----------------------|-----------|-----------|
|      |                                 |                                 | RDR #3566            | RDR #3688 | RDR #3633 |
| 2    | 12.0                            | 12.2                            | 56.4                 | 62.1      | 61.0      |
|      |                                 | 12.3                            | 74.0                 | 79.0      | 78.3      |

## Local Oscillator Pulling

| RDR<br>Rcvr | Frequency<br>(mcs.) | Cycles Shift Caused By<br>Decreasing The Receiver<br>Gain Control From<br>Maximum to Minimum | Cycles Shift Caused By<br>Increasing The RF Sig.<br>Gen. Input From 2 to<br>200,000 uv. |
|-------------|---------------------|----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| #3566       | 18.0                | 3580                                                                                         | * 9540                                                                                  |
| #3688       | 18.0                | 3300                                                                                         | 9200                                                                                    |
| #3633       | 18.0                | 3060                                                                                         | 7620                                                                                    |

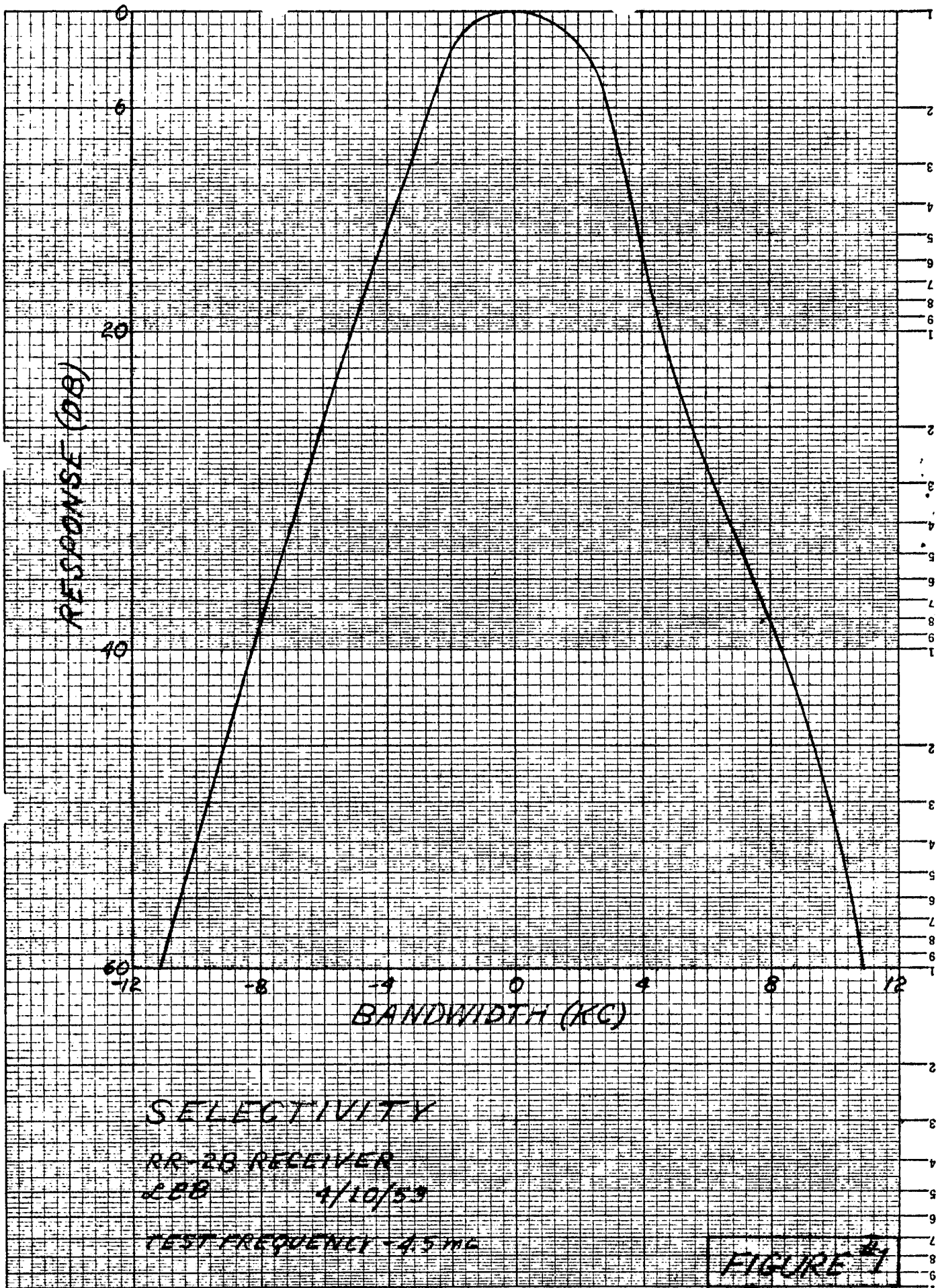
\* The receiver gain was set to maximum for this test.

6. RDR Comparison Tests

Three of the tests in which the N.E.M.S. prototype receiver failed to meet specifications were rerun using average production models of the RR-2B built by RDR. The results show that the RDR models come closer to the requirements for antenna input impedance and spurious responses, but are worse offenders in local oscillator pulling.

7. Conclusion

Because of the electrical and mechanical defects noted, the N.E.M.S. RR-2B receiver, serial #3000, was returned to the manufacturer. The corrected prototype is to be resubmitted to the Analysis and Appraisal Unit at a later date.



KEUFFEL & ESSER CO., N. Y. NO. 359-B1  
Semi-Logarithmic, 1 Cycle X 10 to the left.  
Made in U. S. A.



359-5 KEUFFEL & ESSER CO  
10 x 10 to the inch.  
MADE IN U.S.A.

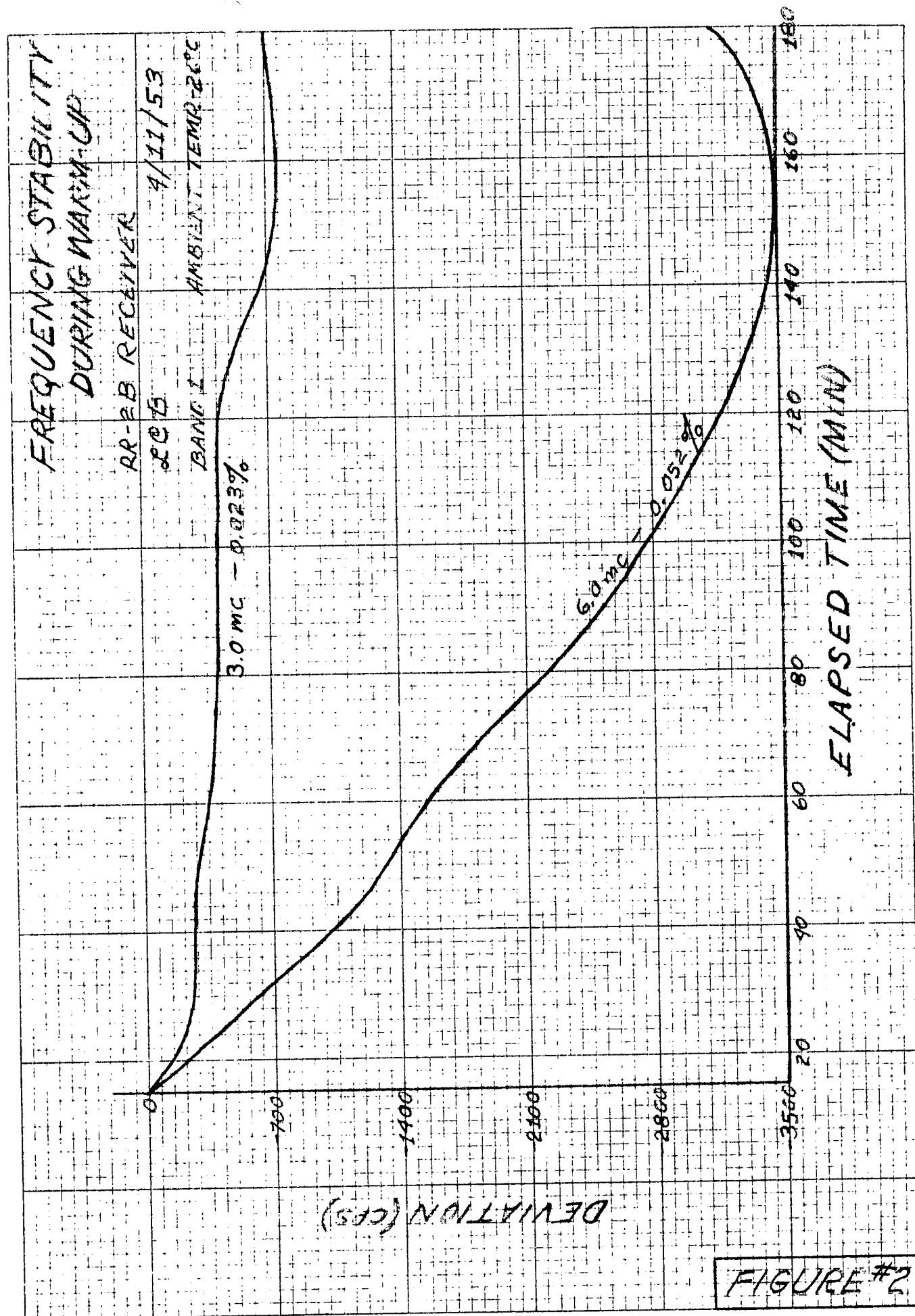
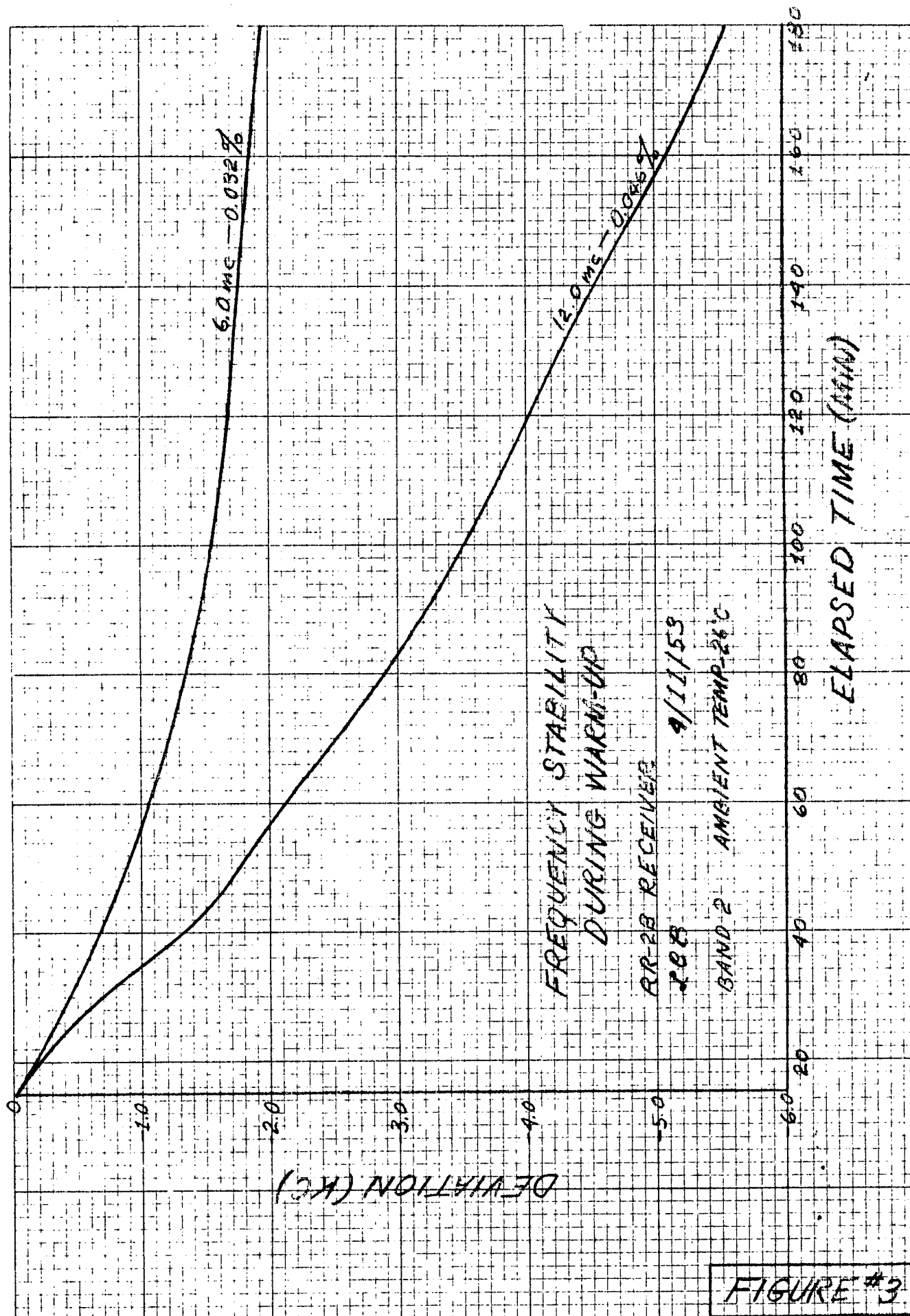


FIGURE #2

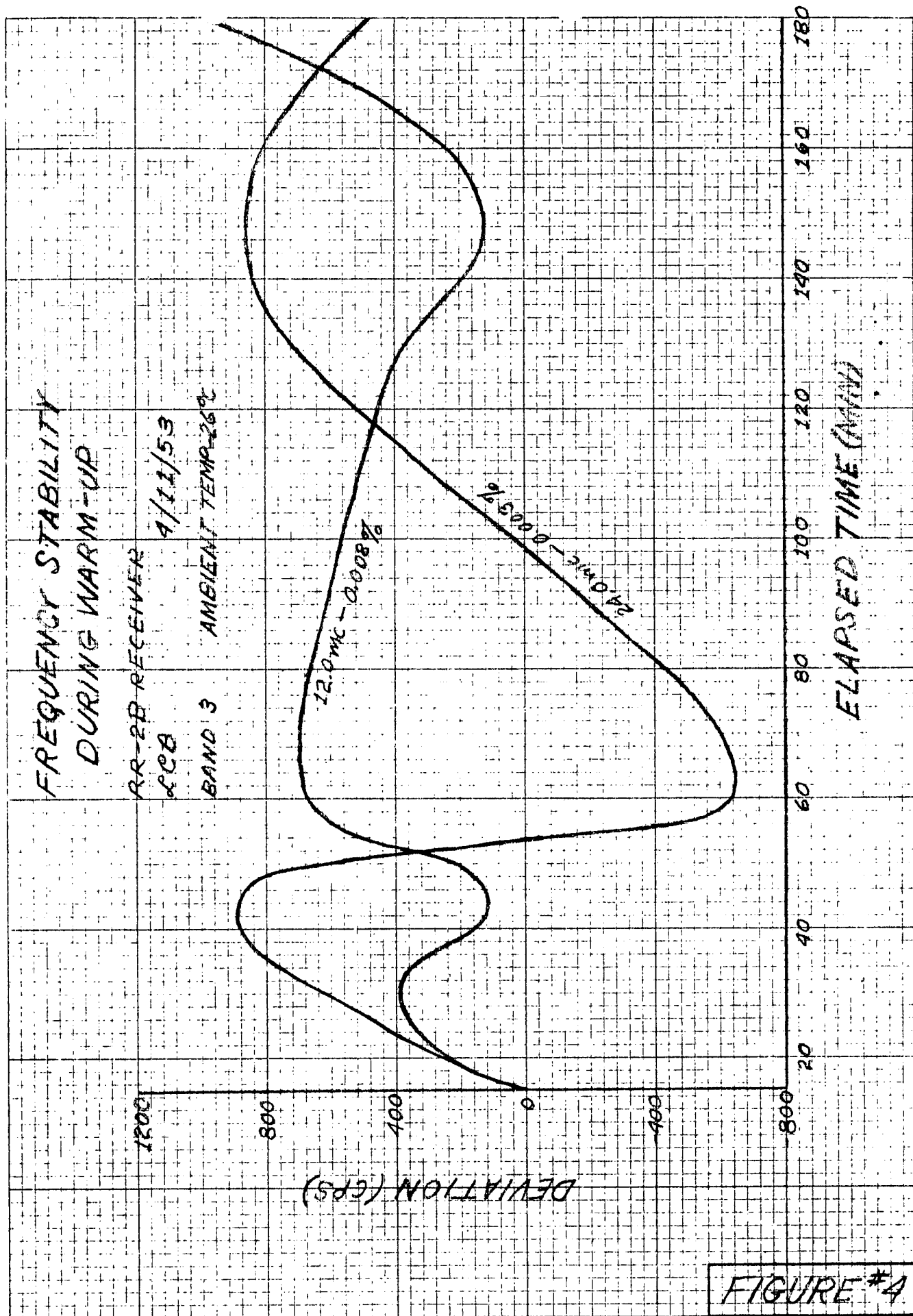
359-S KEUFFEL & ESSER CO  
1 1/2" x 10" to the inch  
MADE IN U.S.A.



399-B KEUFFEL & ESSER CO

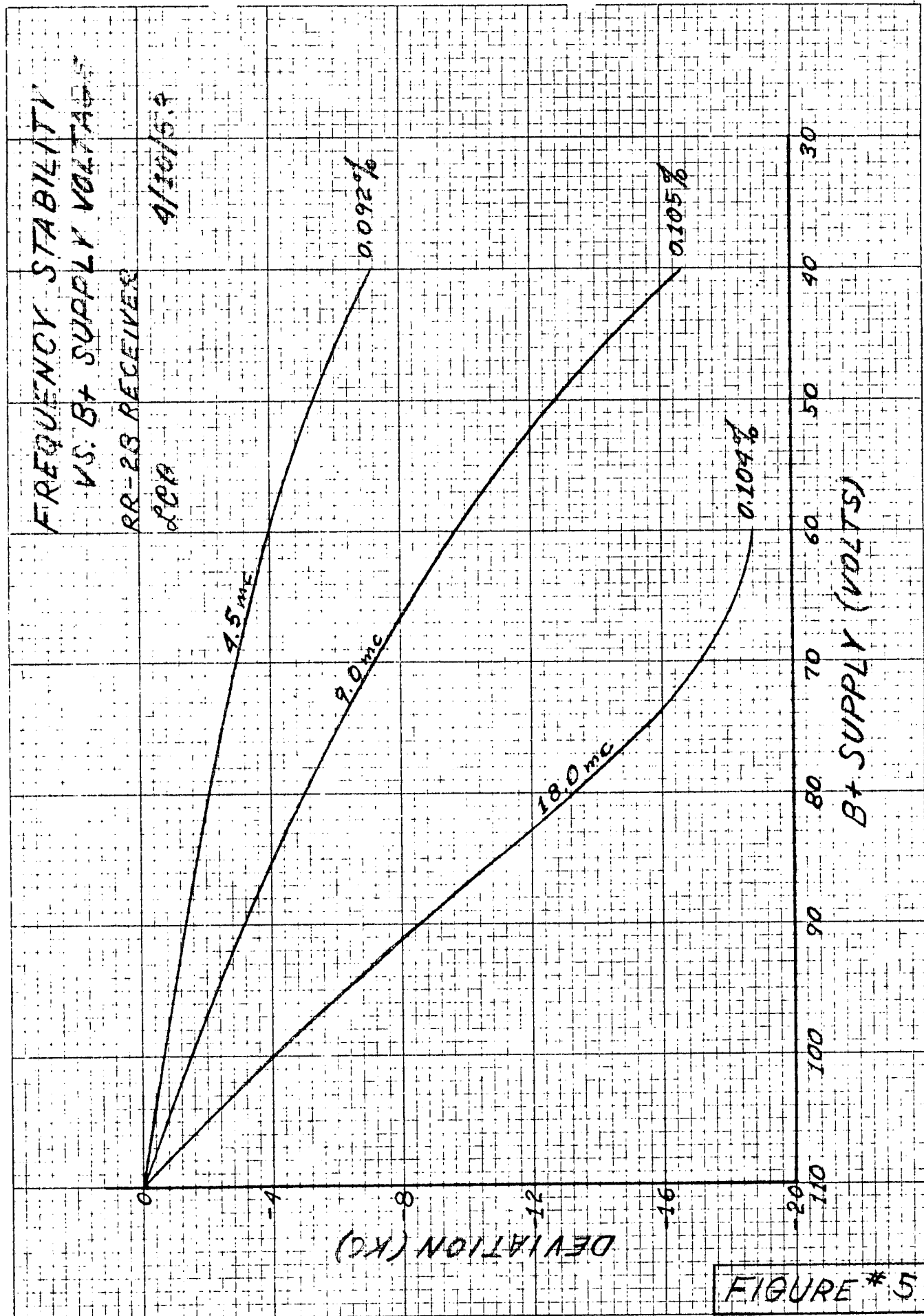
1 1/2 x 10 to the inch

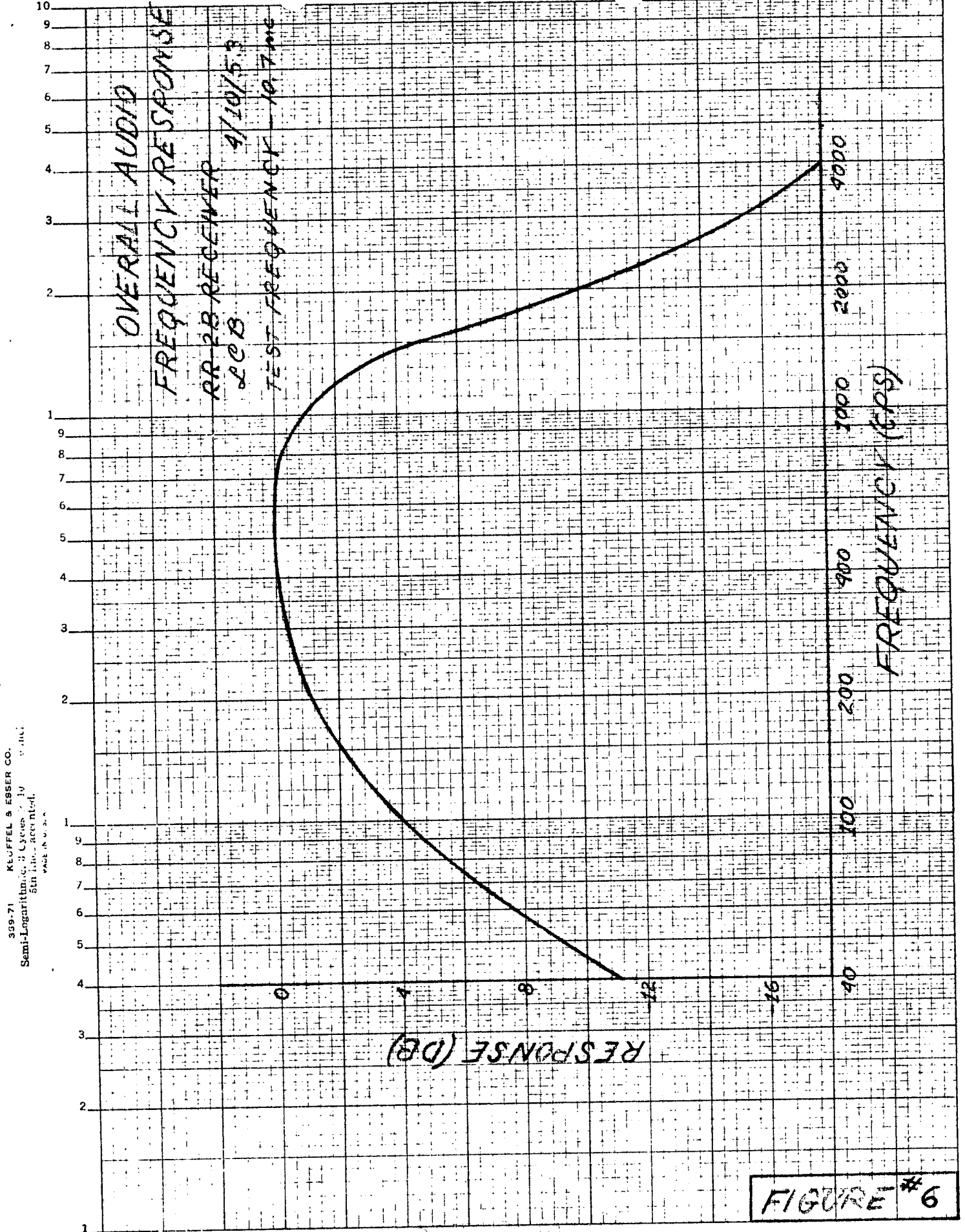
MADE IN U.S.A.



**FIGURE #4**

359-S KEUFFEL & ESSER CO  
10 X 10 to the inch  
TYPE 100-A





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